NEONATOLOGY

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MORTALITY IN KENNELS - WHAT WE LEARNT FROM A STUDY ON 200 000 PUPPIES?

Introduction
One of the major issue in breeding kennels is high rate of mortality in puppies. We estimate that mortality before weaning can vary from 5 until 50% depending on kennels. However, only few studies evaluated the mean rate of early puppies' mortality on large number of dogs. Data on fertility existing in the literature were also obtained on limited number of dogs or at veterinary clinics dedicated to assisted reproduction and may thus not be representative. On the base of data collected via Norwegian kennel club (on 10,810 litters comprising more than 58,000 puppies), one study estimated puppy perinatal mortality rate at 8% (stillbirth and mortality within the first 7 days after birth) [1]. Another study, using the same dataset estimated the litter size depending on breed [2]. The data on reproductive performances, such as whelping rate, litter size or survival remain limited for canine reproduction.

Using a large data set collected from French breeders, our goal was thus to determine the main reproductive indicators, describing the efficiency of the breeding kennel, and particularly the puppies' survival until weaning [3].

The data were collected via a software dedicated to canine breeders (Breeding Menagement System, BMS, Royal Canin, Aimargues,France). Only mated females were included in the analysis.

Fertility
Data on 45,913 heats were analyzed from 27,221 bitches from 248 breeds. Considering the adult body weight, 56% of bitches belonged to mini breeds, 17.4% to medium, 20.5% to maxi and 6.1% to giant. The five most represented breeds were Chihuahua (7.8% of the heats, 2132 bitches), Yorkshire Terrier (6.2%; 1698), Cavalier King Charles Spaniel (6.1%; 1668), French Bulldog (5.2%; 1425) and German Shepherd (4.0%; 1093). At mating, the mean age was 3.1±1.8 years (mean ± SD) for females and 3.3±2.0 for males. Males originated from the same kennel as the female for 88.5% of the matings.

Pregnancy rate was 88.7% (40,748/45,913) and abortion rate was 6.8% (2,771/40,748). Finally, 81.9% of the mated females gave birth to a litter.

Mortality in puppies
A total of 204 537 puppies were born from 37 946 litters. The number of puppies included in this study corresponded to 20% of all puppies born registered to the French kennel club during the entire study period. Sex ratio (male:female) was 51.2%. Mean litter size was 5.4 ± 2.8 puppies, with a range from 1 puppy to 24 puppies. Young bitches (below 2 years old) had smaller litter sizes than adult (between 2 and 6 years old) and greater than senior (above 6 years old): 5.2 ± 2.6 for young, 5.4 ± 2.7 for adult, 4.9 ± 2.7 for senior. Total mortality rate from birth until selling was 13.4%. Stillbirth (puppies born dead at term) was 7.4%, accounting for 54.8% of the total mortality (from birth to selling). One litter of five (20.5%) contained at least one stillborn puppy whereas 15.5% contained at least one case of neonatal mortality (within the first three weeks of life) or pediatric mortality (between 3 weeks and selling). In total, 31.5% of the litters experienced at least one case of death, either stillbirth or neonatal and pediatric mortality. In total, 5.4 puppies were born and 4.6 puppies sold per whelped bitch; when calculated per mated bitch, the productivity was of 4.4 puppies born, among which 3.8 were sold. Mortality in puppies was strongly influenced not only by breed size, but also by breed (Table 1 and Table 2).

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Mila et al. Table 1. Reproductive performances depending on breed size.

	Mini	Medium	Maxi	Giant
Adult weight	<10kg	10-25kg	25-45kg	>45kg
Number of included heats	25 707	8006	9405	2794
Prolificacy [1]	4.3±2.0 [a]	6.1±2.6 [b]	7.2±3.1 [c]	7.4±3.6 [c]
Stillbirth rate [2]	7.3% [a]	6.3% [a]	7.4% [b]	10.0% [a]
Postnatal mortality rate [3]	6.8% [ab]	5.1% [b]	5.4% [bc]	6.2% [c]
Number of puppies sold /whelped bitch	3.7±2.0 [a]	5.4±2.6 [b]	6.3±2.9 [c]	6.2±3.3 [c]

[1]   Total number of puppies born per litter (mean ± standard deviation)

[2]   Number of stillborn puppies / total number of puppies born

[3]   Number of puppies dying between birth and selling/number of puppies born alive

[a–c]   Mean values within a row with different superscripts were significantly different (P < 0.05).

Mila et al. Table 2. Reproductive performances depending on breed within one breed size (mini).

	Chihuahua	Cavalier King Charles	Yorkshire terrier	French Bouledogue
Number of included heats	2973	2561	2527	1724
Prolificacy 1	3.5±1.6 [a]	4.4±2.0 [b]	3.7±1.7 [c]	4.9±2.2 [d]
Stillbirth rate 2	8.0% [a]	8.8%a [b]	7.4% [a]	10.3% [b]
Postnatal mortality rate 3	7.1% [a]	7.5% [a]	6.9% [a]	10.2% [b]
Number of puppies sold /whelped bitch	3.0±1.6 [a]	3.7±2.0 [b]	3.2±1.7 [c]	4.0±2.2 [d]

[1]   Total number of puppies born per litter (mean ± standard deviation)

[2]   Number of stillborn puppies / total number of puppies born

[3]   Number of puppies dying between birth and selling/number of puppies born alive

[a–d]   Mean values within a row with different superscripts were significantly different (P < 0.05).

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